OIPE JC139
APR 26 2005
PATENT & TRADEMARK OFFICE

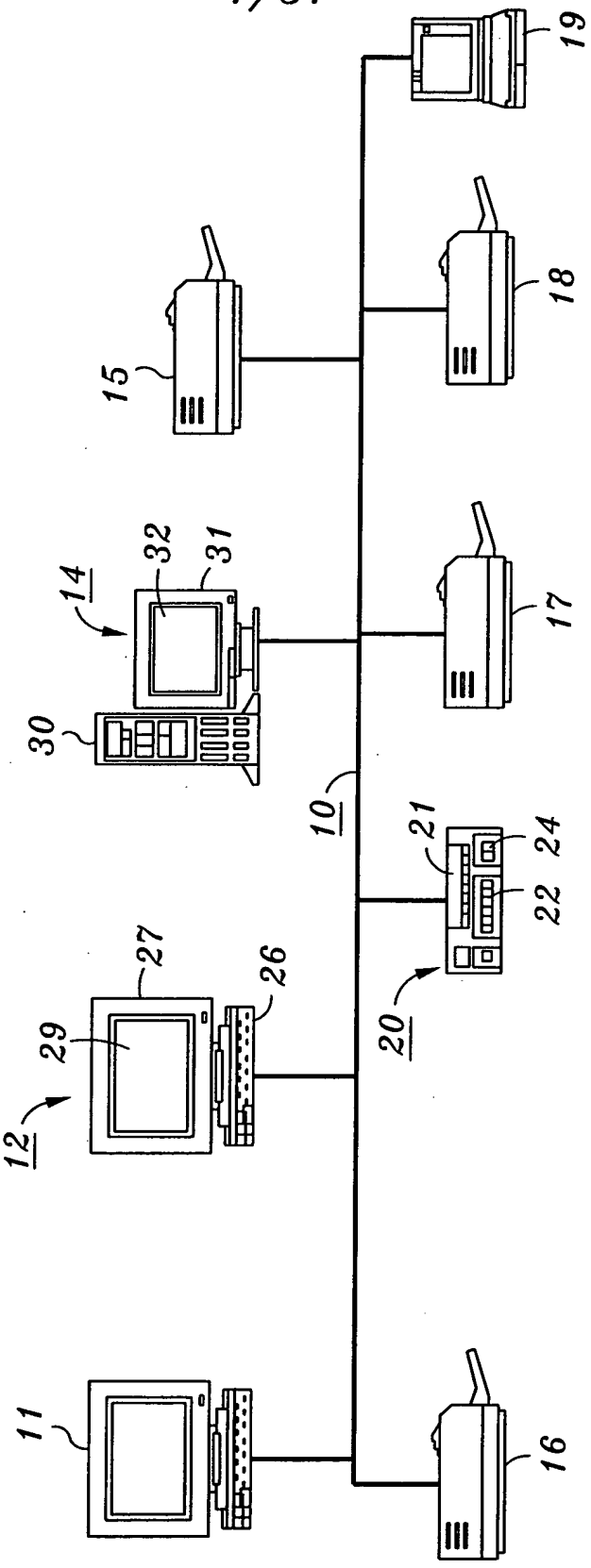


FIG. 1

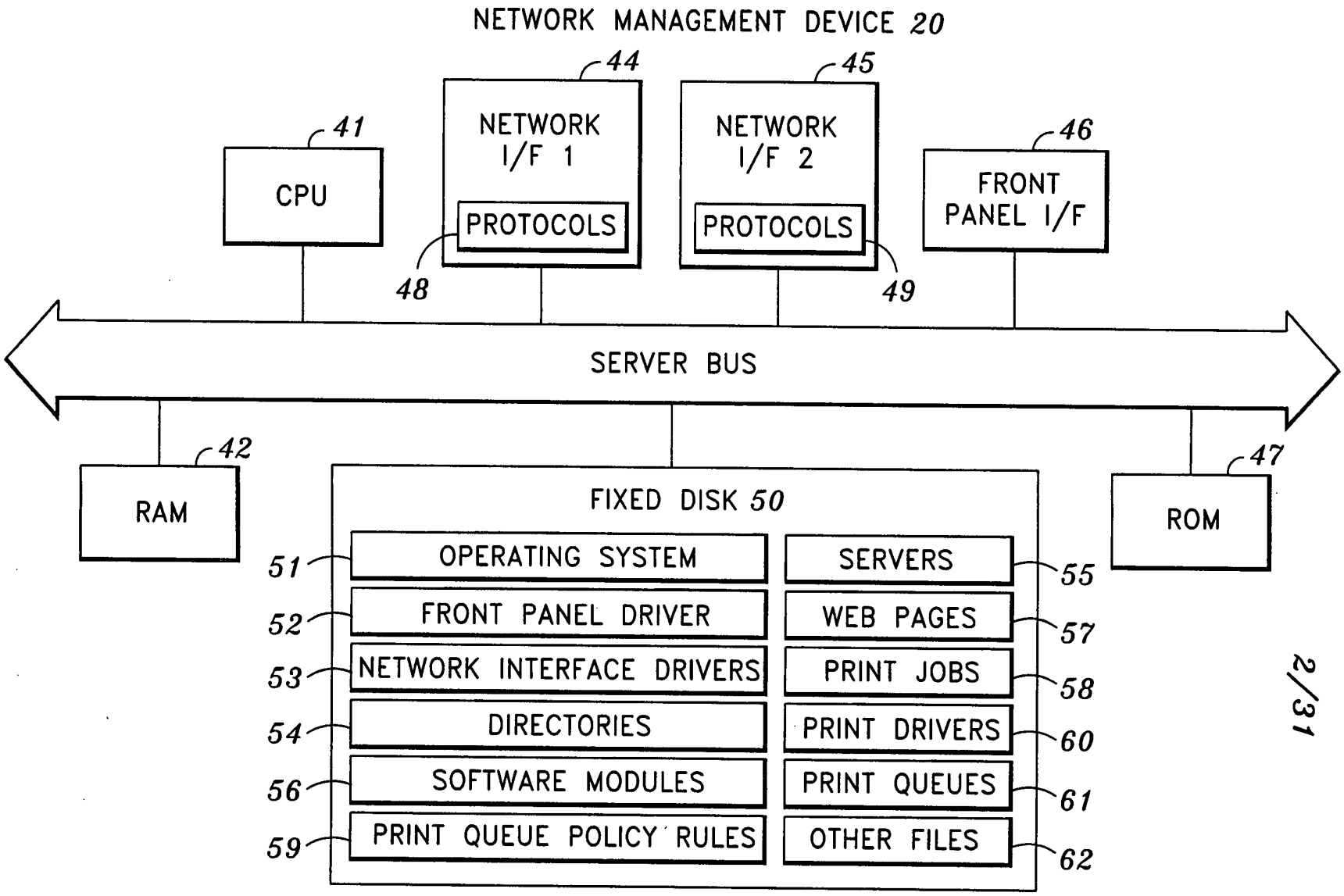

NETWORK MANAGEMENT DEVICE 20
44
45
41
NETWORK I/F 1
NETWORK I/F 2
46
CPU
PROTOCOLS
PROTOCOLS
FRONT PANEL I/F
48
49
SERVER BUS
42
47
RAM
FIXED DISK 50
ROM
51
OPERATING SYSTEM
SERVERS
55
52
FRONT PANEL DRIVER
WEB PAGES
57
53
NETWORK INTERFACE DRIVERS
PRINT JOBS
58
54
DIRECTORIES
PRINT DRIVERS
60
56
SOFTWARE MODULES
PRINT QUEUES
61
59
PRINT QUEUE POLICY RULES
OTHER FILES
62

FIG. 2

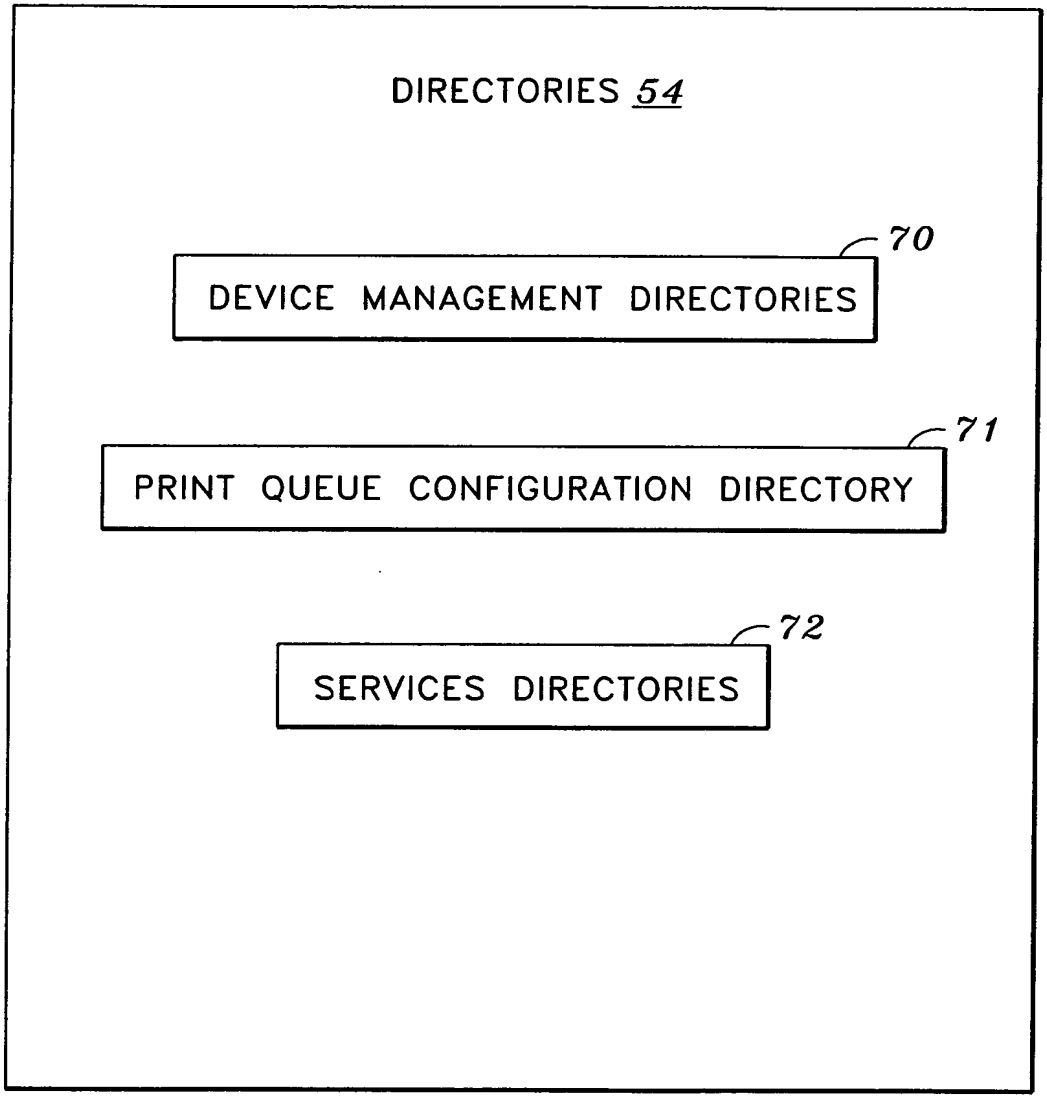

DIRECTORIES 54
70
DEVICE MANAGEMENT DIRECTORIES
71
PRINT QUEUE CONFIGURATION DIRECTORY
72
SERVICES DIRECTORIES

FIG. 3

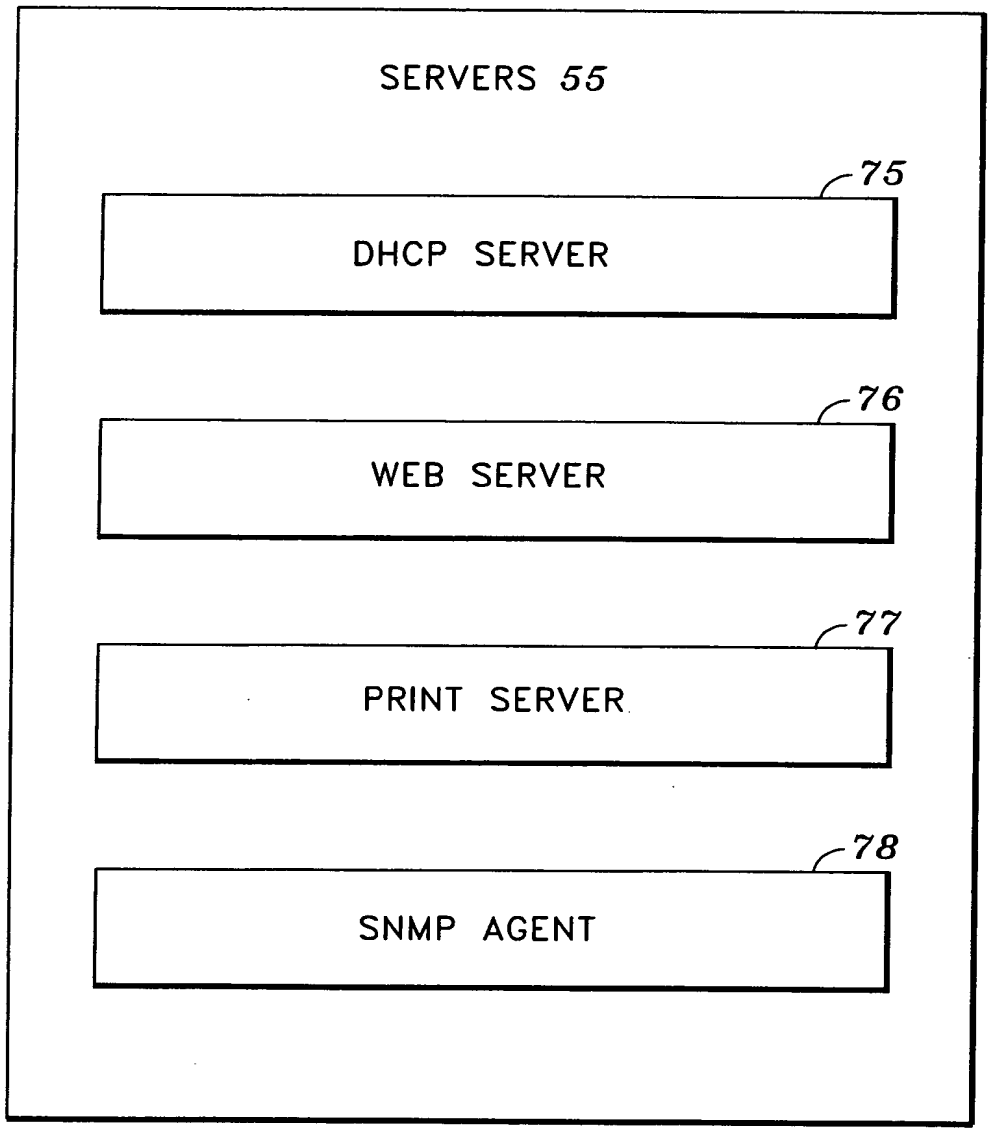

SERVERS 55
75
DHCP SERVER
76
WEB SERVER
77
PRINT SERVER
78
SNMP AGENT

FIG. 4

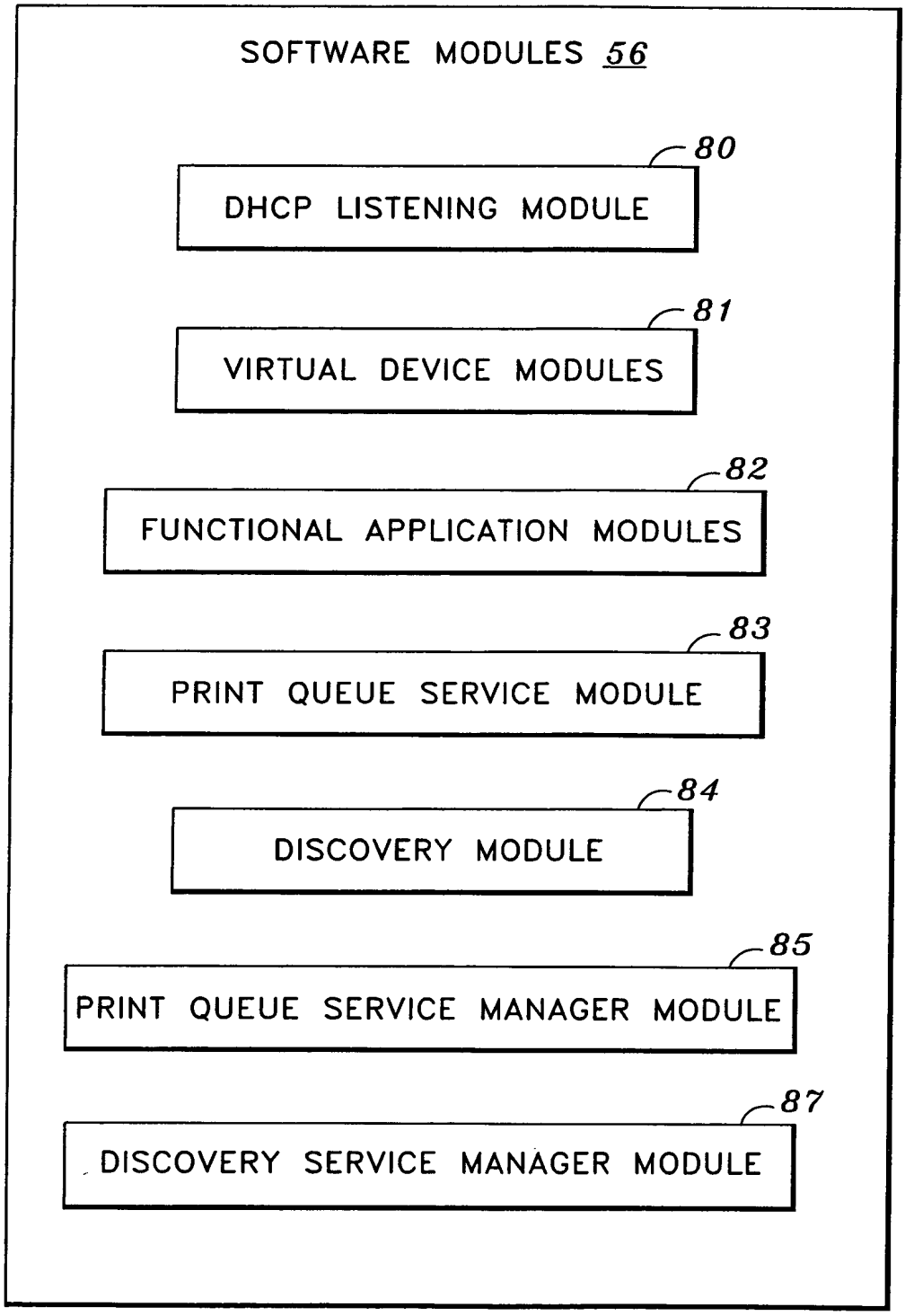

SOFTWARE MODULES 56
80
DHCP LISTENING MODULE
81
VIRTUAL DEVICE MODULES
82
FUNCTIONAL APPLICATION MODULES
83
PRINT QUEUE SERVICE MODULE
84
DISCOVERY MODULE
85
PRINT QUEUE SERVICE MANAGER MODULE
87
DISCOVERY SERVICE MANAGER MODULE

FIG. 5

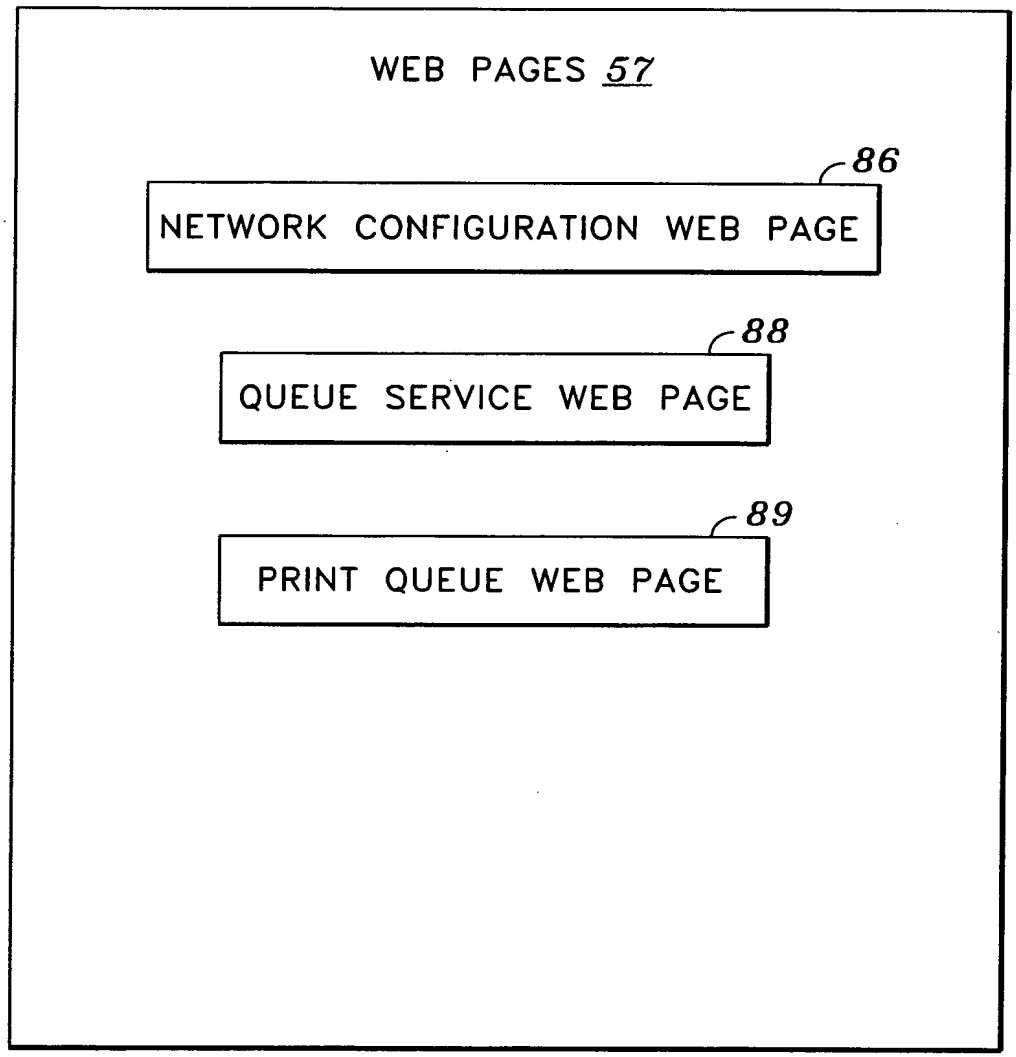

WEB PAGES 57
86
NETWORK CONFIGURATION WEB PAGE
88
QUEUE SERVICE WEB PAGE
89
PRINT QUEUE WEB PAGE

FIG. 6

DEVICE MANAGEMENT DIRECTORY *70*

ENTRY *90*	MAC ADDRESS *91*	PRINT DEVICE TYPE *92*	IP ADDRESS *93*	NETWORK CONFIGURATION INFORMATION *94*
Entry 1	00:00:85:69:0A:B3	Canon Laser	129.65.220.8	Domain Name, etc.
- -	- -	- -	- -	- -
- -	- -	- -	- -	- -
- -	- -	- -	- -	- -
- -	- -	- -	- -	- -
- -	- -	- -	- -	- -
- -	- -	- -	- -	- -
Entry N	- -	- -	- -	- -

FIG. 7

PRINT QUEUE CONFIGURATION DIRECTORY *71*

	IP ADDRESS *100*	MAC ADDRESS *101*	PRINT QUEUE NAME *102*	PRINTING CAPABILITIES *103*	SERVER *105*
Entry 1	129.65.220.8	00:00:85:69:0A:B3	Canon Laser	Color, Letter, A4	Main A
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
ENTRY N	--	--	--	--	--

FIG. 8

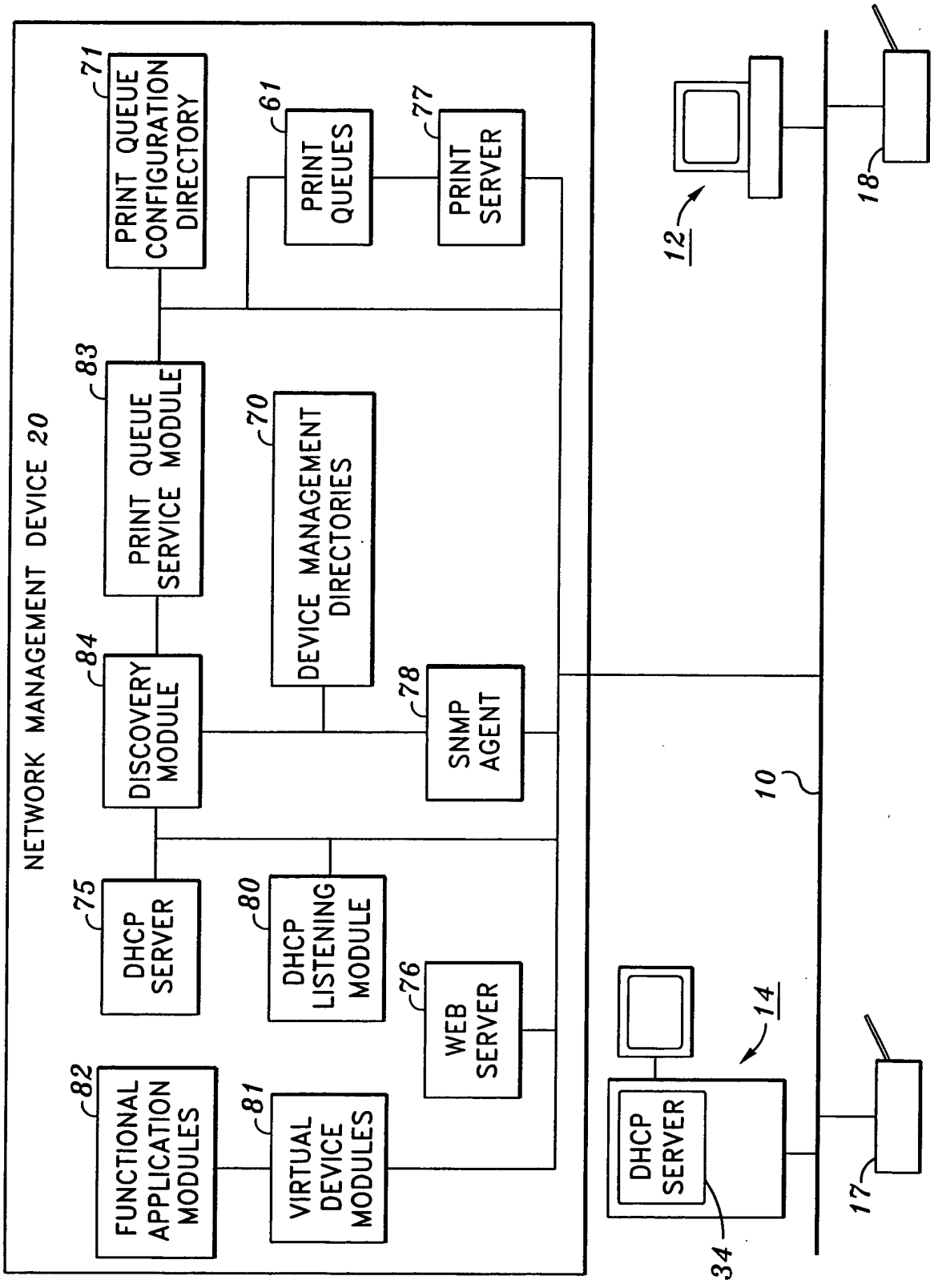

NETWORK MANAGEMENT DEVICE 20
PRINT QUEUE CONFIGURATION DIRECTORY
71
PRINT QUEUES
61
PRINT SERVER
77
PRINT QUEUE SERVICE MODULE
83
DEVICE MANAGEMENT DIRECTORIES
70
DISCOVERY MODULE
84
SNMP AGENT
78
DHCP SERVER
75
DHCP LISTENING MODULE
80
WEB SERVER
76
FUNCTIONAL APPLICATION MODULES
82
VIRTUAL DEVICE MODULES
81
12
18
10
14
DHCP SERVER
34
17

FIG. 9

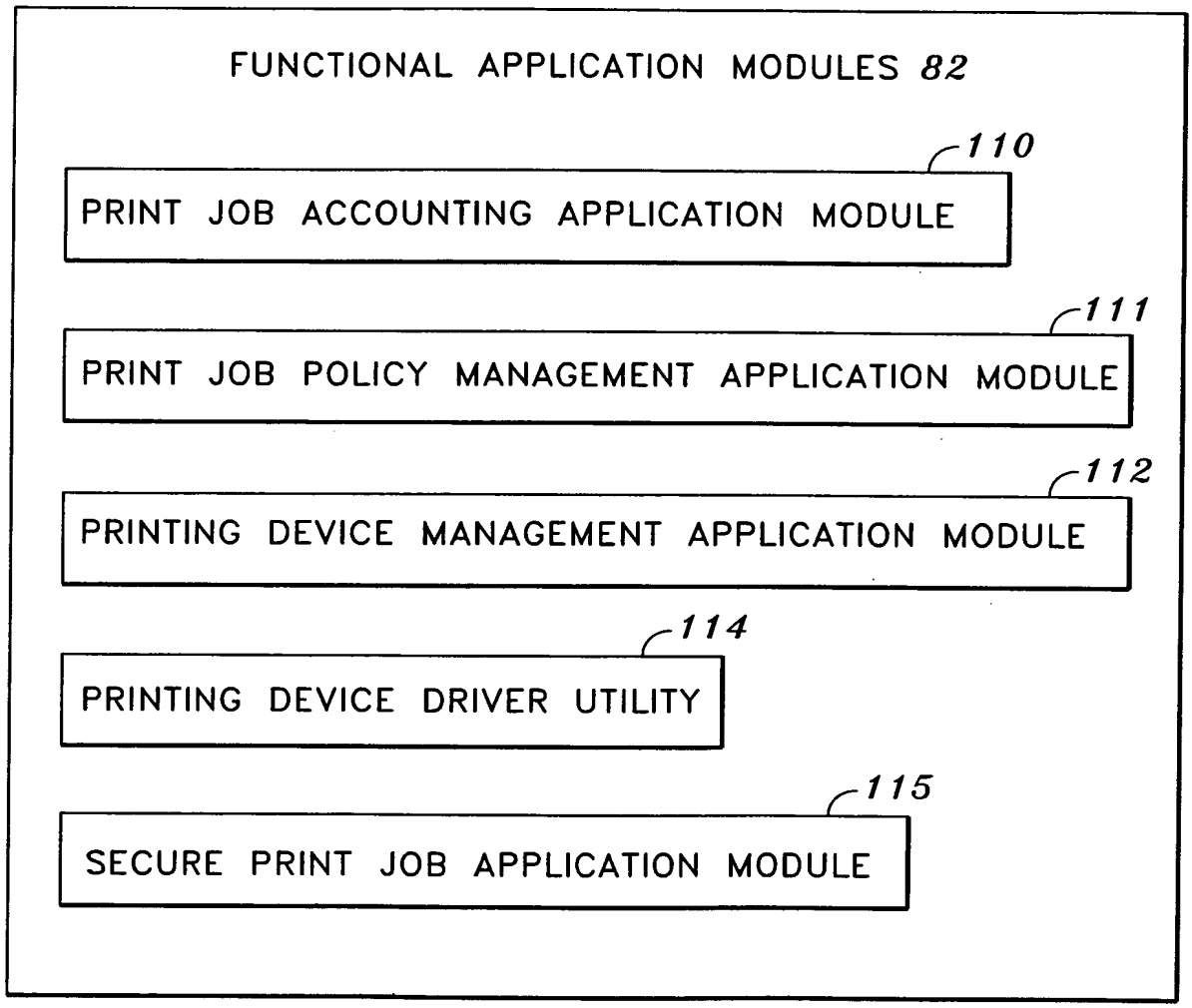

FUNCTIONAL APPLICATION MODULES 82
110
PRINT JOB ACCOUNTING APPLICATION MODULE
111
PRINT JOB POLICY MANAGEMENT APPLICATION MODULE
112
PRINTING DEVICE MANAGEMENT APPLICATION MODULE
114
PRINTING DEVICE DRIVER UTILITY
115
SECURE PRINT JOB APPLICATION MODULE

FIG. 10

SERVICES DIRECTORIES 72

120

LOCAL SERVICES DIRECTORY

122 SUBNET ID	124 SERVICE	125 NMD ID
1	DISCOVERY	NMD 1
1	PRINT QUEUE	NMD 2

121

GLOBAL SERVICES DIRECTORY

122 SUBNET ID	124 SERVICE	125 NMD ID
1	PRINT QUEUE	NMD 1
1	DISCOV. SERV. MGR.	NMD 3
1	GLOBAL INFO SERV.	NMD 1

FIG. 11

GLOBAL SERVICES DIRECTORY 121

SUBNET ID (122)	SERVICE (124)	NMD ID (125)
1	MASTER	NMD 1
1	DISC. SERV. MGR.	NMD 3
1	GLOBAL INFO SERV.	NMD 1
1	PRINT QU. SERV. MGR.	NMD 3
•		
•		
•		
•		

FIG. 12

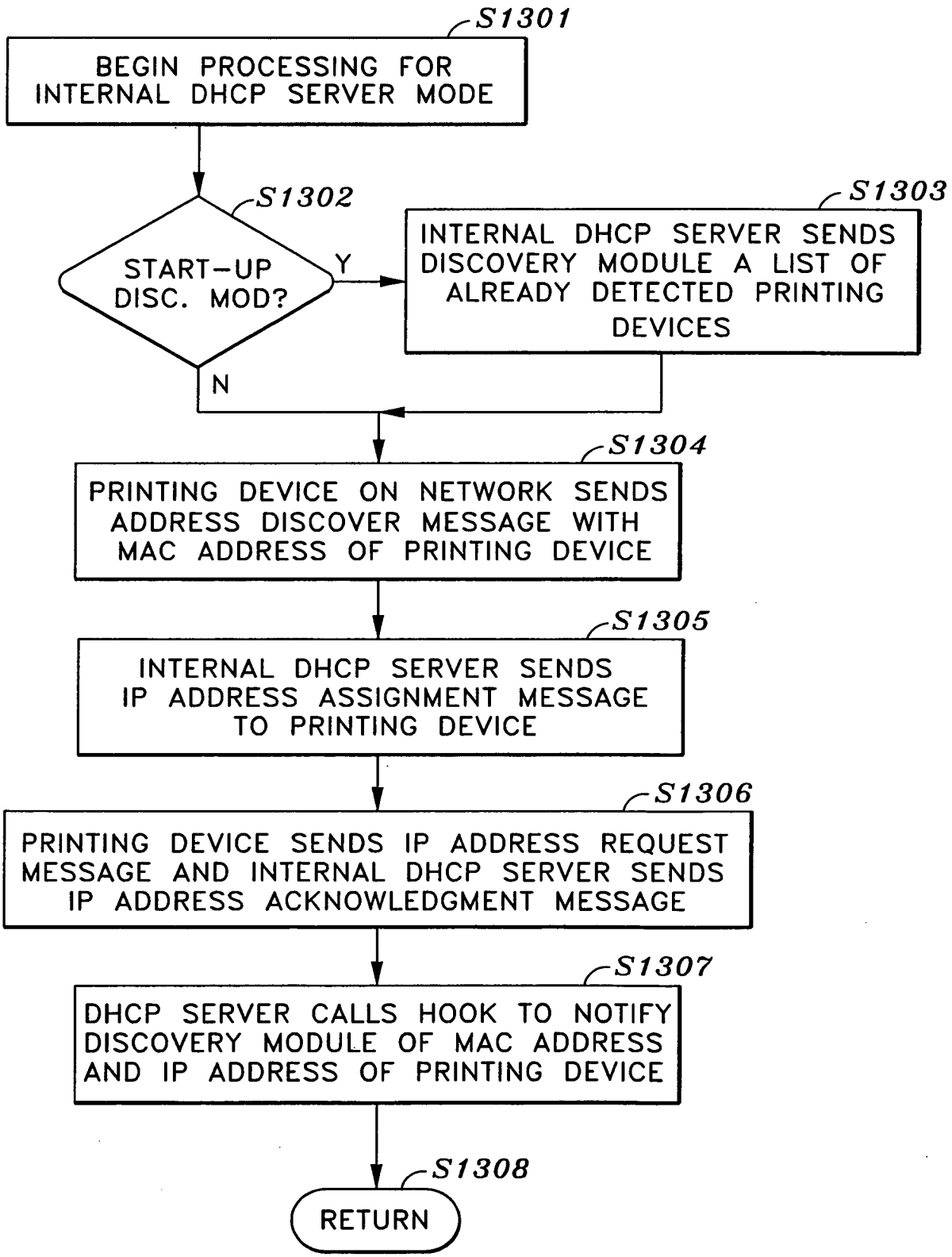

S1301
BEGIN PROCESSING FOR INTERNAL DHCP SERVER MODE
S1302
START-UP DISC. MOD?
Y
N
S1303
INTERNAL DHCP SERVER SENDS DISCOVERY MODULE A LIST OF ALREADY DETECTED PRINTING DEVICES
S1304
PRINTING DEVICE ON NETWORK SENDS ADDRESS DISCOVER MESSAGE WITH MAC ADDRESS OF PRINTING DEVICE
S1305
INTERNAL DHCP SERVER SENDS IP ADDRESS ASSIGNMENT MESSAGE TO PRINTING DEVICE
S1306
PRINTING DEVICE SENDS IP ADDRESS REQUEST MESSAGE AND INTERNAL DHCP SERVER SENDS IP ADDRESS ACKNOWLEDGMENT MESSAGE
S1307
DHCP SERVER CALLS HOOK TO NOTIFY DISCOVERY MODULE OF MAC ADDRESS AND IP ADDRESS OF PRINTING DEVICE
S1308
RETURN

FIG. 13A

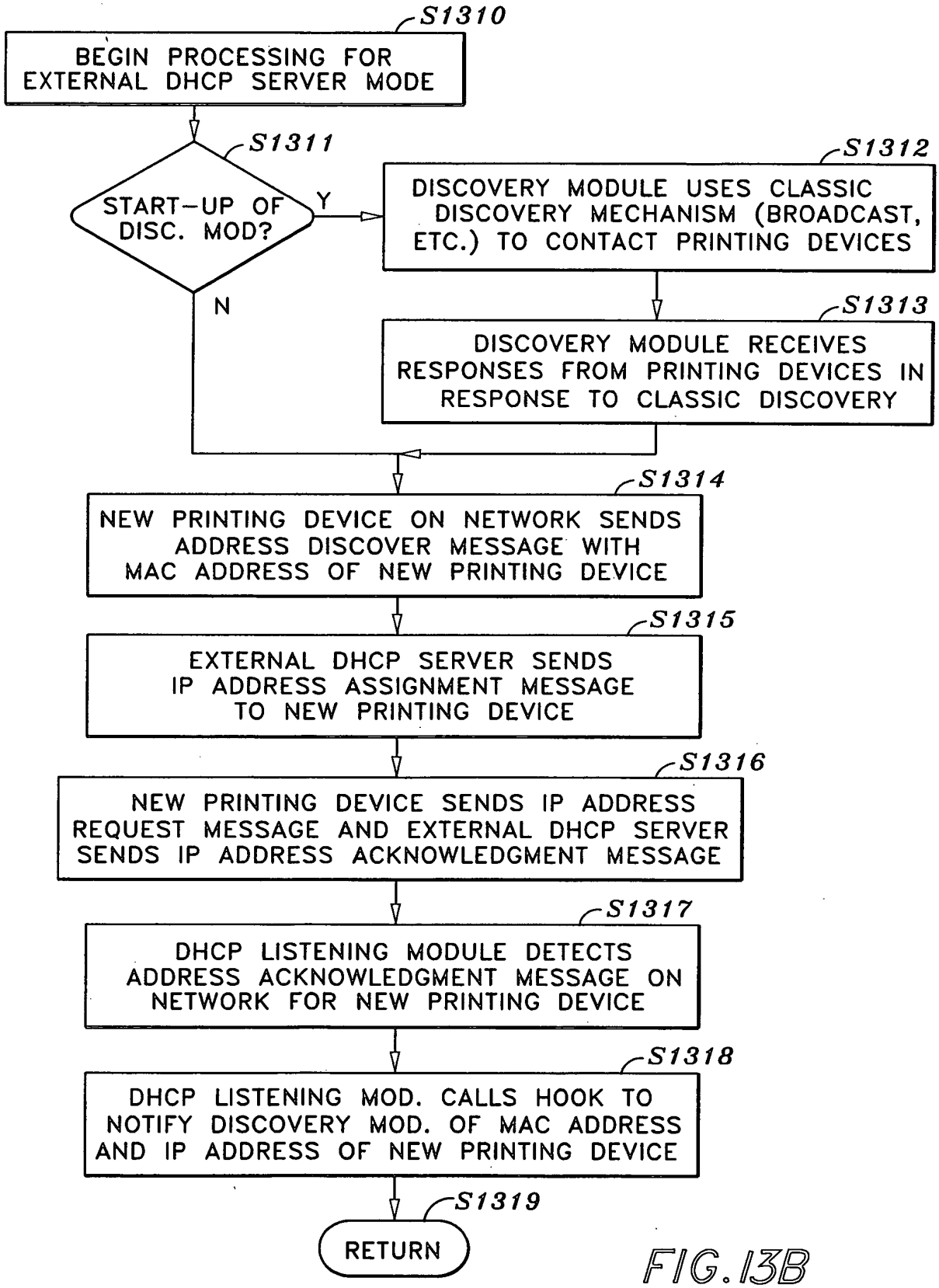

S1310
BEGIN PROCESSING FOR EXTERNAL DHCP SERVER MODE
S1311
START-UP OF DISC. MOD?
Y
N
S1312
DISCOVERY MODULE USES CLASSIC DISCOVERY MECHANISM (BROADCAST, ETC.) TO CONTACT PRINTING DEVICES
S1313
DISCOVERY MODULE RECEIVES RESPONSES FROM PRINTING DEVICES IN RESPONSE TO CLASSIC DISCOVERY
S1314
NEW PRINTING DEVICE ON NETWORK SENDS ADDRESS DISCOVER MESSAGE WITH MAC ADDRESS OF NEW PRINTING DEVICE
S1315
EXTERNAL DHCP SERVER SENDS IP ADDRESS ASSIGNMENT MESSAGE TO NEW PRINTING DEVICE
S1316
NEW PRINTING DEVICE SENDS IP ADDRESS REQUEST MESSAGE AND EXTERNAL DHCP SERVER SENDS IP ADDRESS ACKNOWLEDGMENT MESSAGE
S1317
DHCP LISTENING MODULE DETECTS ADDRESS ACKNOWLEDGMENT MESSAGE ON NETWORK FOR NEW PRINTING DEVICE
S1318
DHCP LISTENING MOD. CALLS HOOK TO NOTIFY DISCOVERY MOD. OF MAC ADDRESS AND IP ADDRESS OF NEW PRINTING DEVICE
S1319
RETURN

FIG. 13B

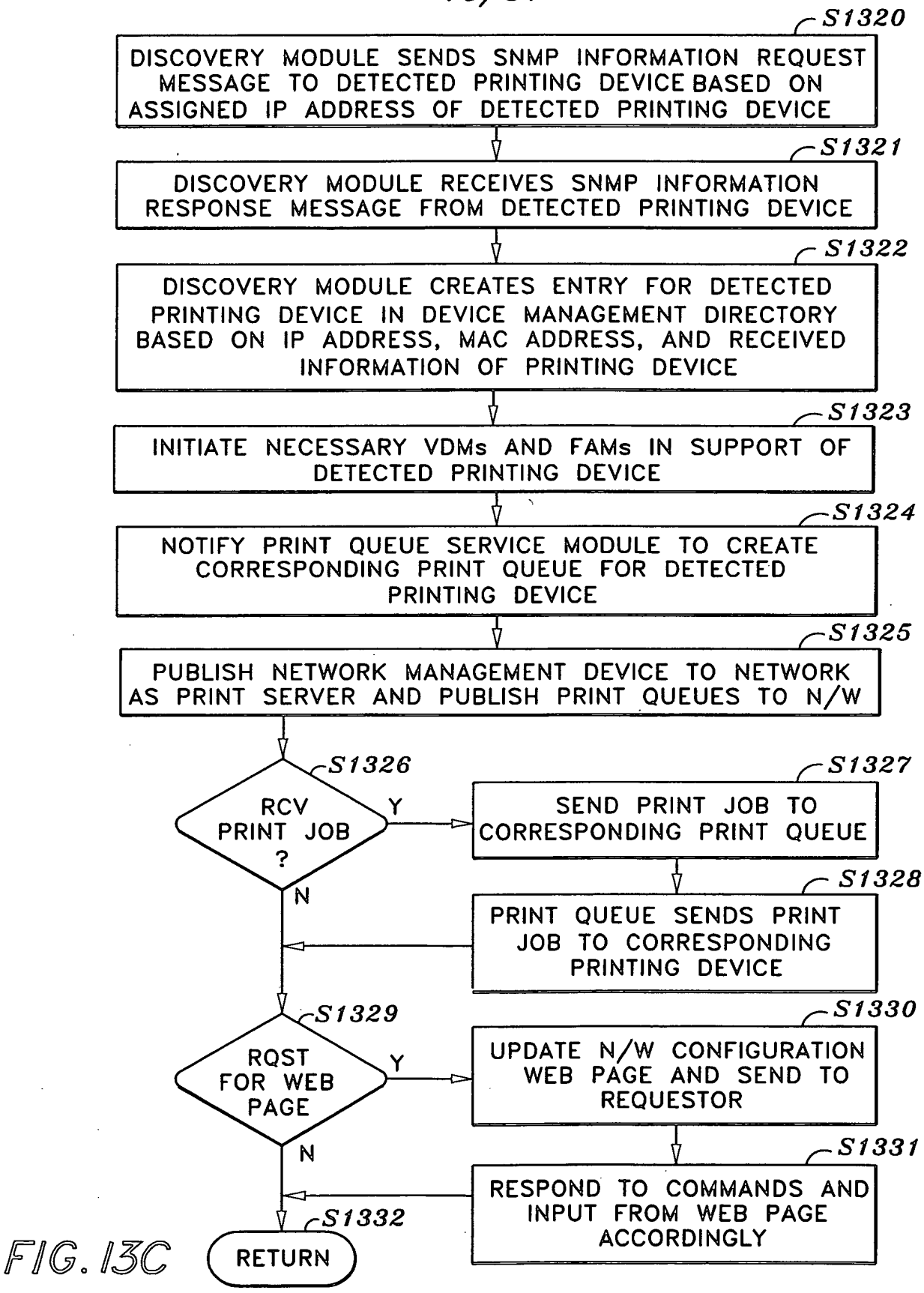

S1320
DISCOVERY MODULE SENDS SNMP INFORMATION REQUEST MESSAGE TO DETECTED PRINTING DEVICE BASED ON ASSIGNED IP ADDRESS OF DETECTED PRINTING DEVICE
S1321
DISCOVERY MODULE RECEIVES SNMP INFORMATION RESPONSE MESSAGE FROM DETECTED PRINTING DEVICE
S1322
DISCOVERY MODULE CREATES ENTRY FOR DETECTED PRINTING DEVICE IN DEVICE MANAGEMENT DIRECTORY BASED ON IP ADDRESS, MAC ADDRESS, AND RECEIVED INFORMATION OF PRINTING DEVICE
S1323
INITIATE NECESSARY VDMs AND FAMs IN SUPPORT OF DETECTED PRINTING DEVICE
S1324
NOTIFY PRINT QUEUE SERVICE MODULE TO CREATE CORRESPONDING PRINT QUEUE FOR DETECTED PRINTING DEVICE
S1325
PUBLISH NETWORK MANAGEMENT DEVICE TO NETWORK AS PRINT SERVER AND PUBLISH PRINT QUEUES TO N/W
S1326
RCV PRINT JOB ?
Y
N
S1327
SEND PRINT JOB TO CORRESPONDING PRINT QUEUE
S1328
PRINT QUEUE SENDS PRINT JOB TO CORRESPONDING PRINTING DEVICE
S1329
RQST FOR WEB PAGE
Y
N
S1330
UPDATE N/W CONFIGURATION WEB PAGE AND SEND TO REQUESTOR
S1331
RESPOND TO COMMANDS AND INPUT FROM WEB PAGE ACCORDINGLY
S1332
RETURN

FIG. 13C

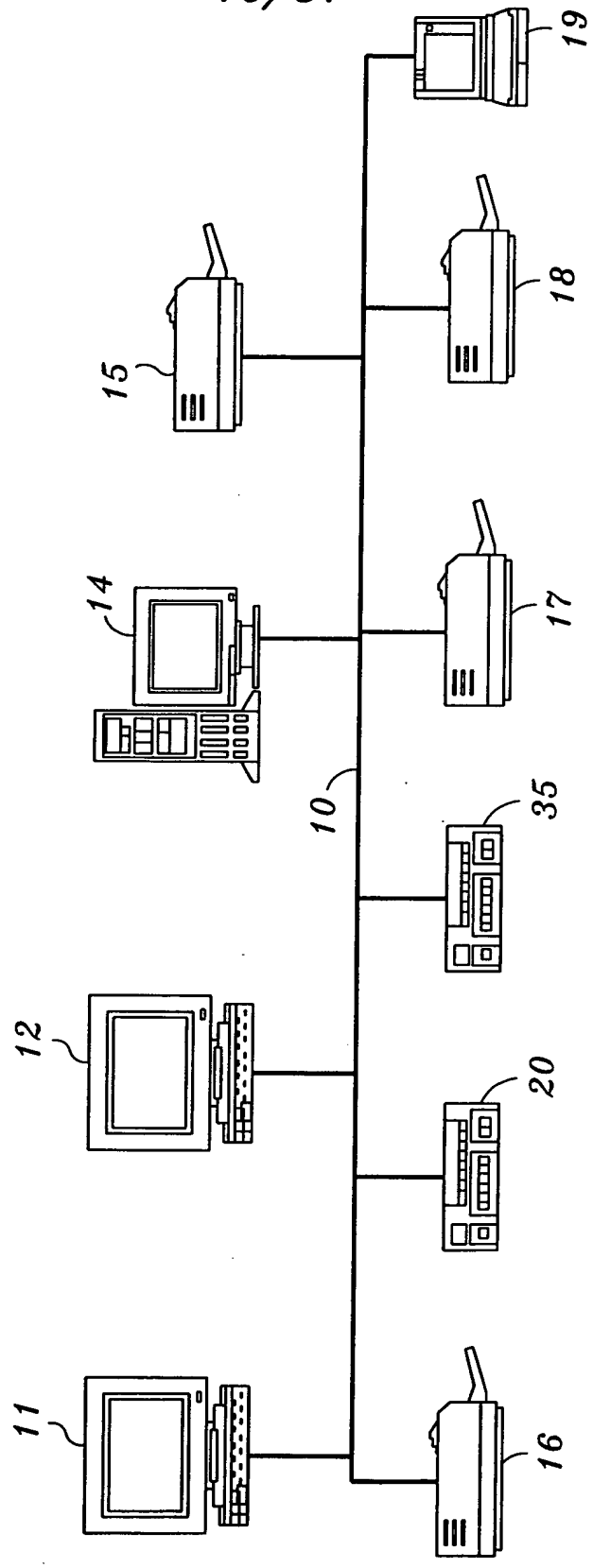


FIG. 14

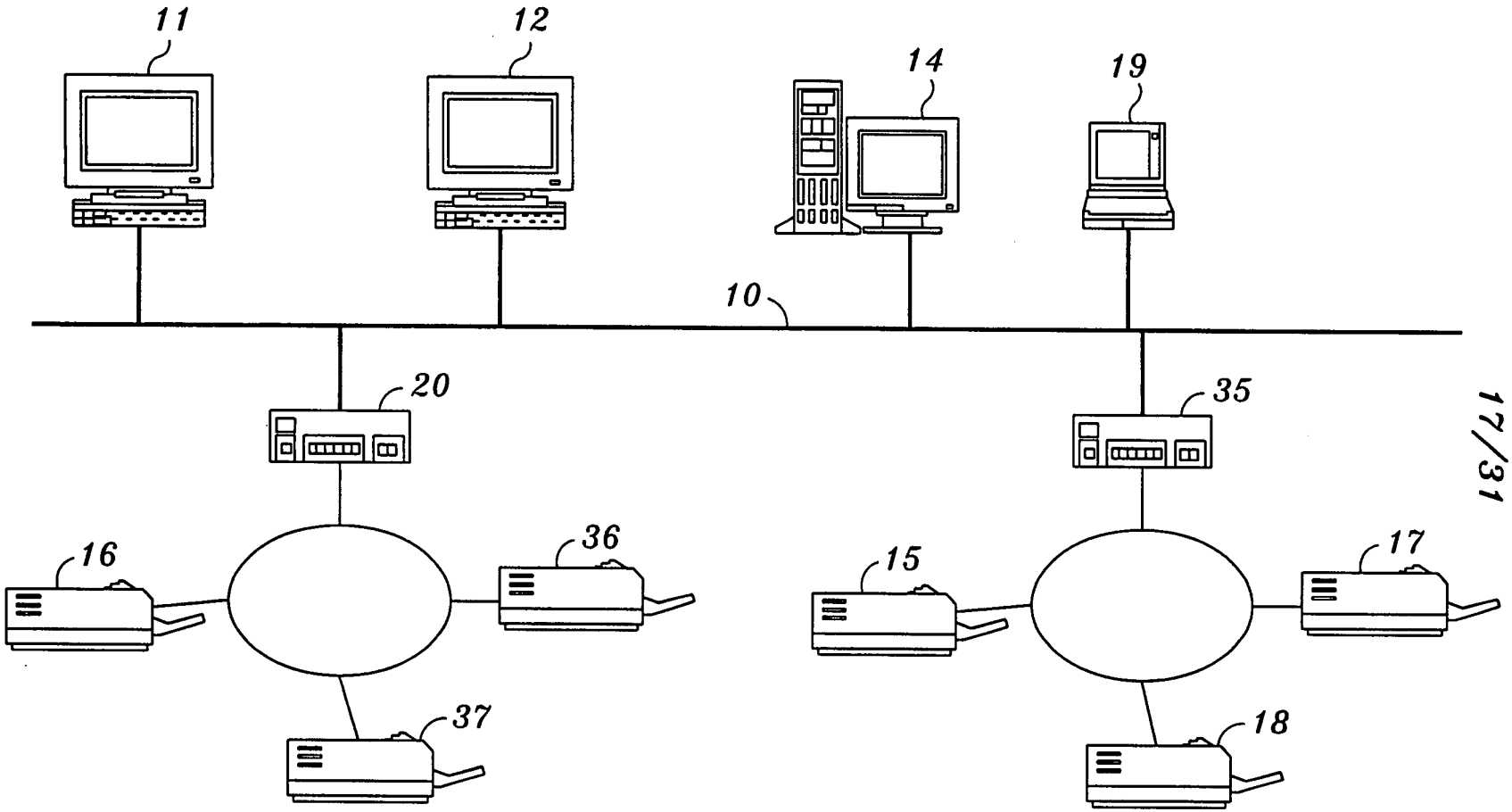


FIG. 15

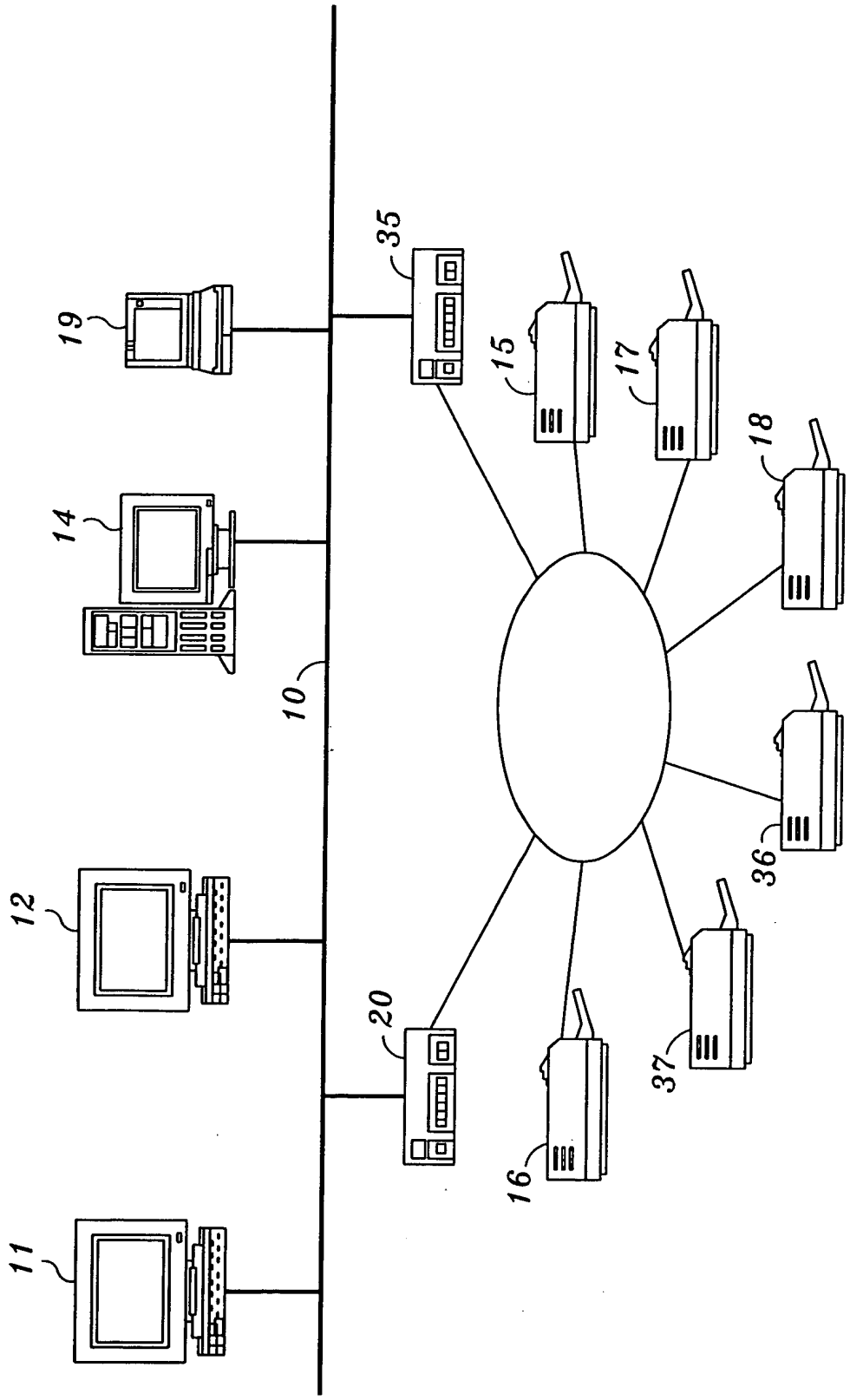
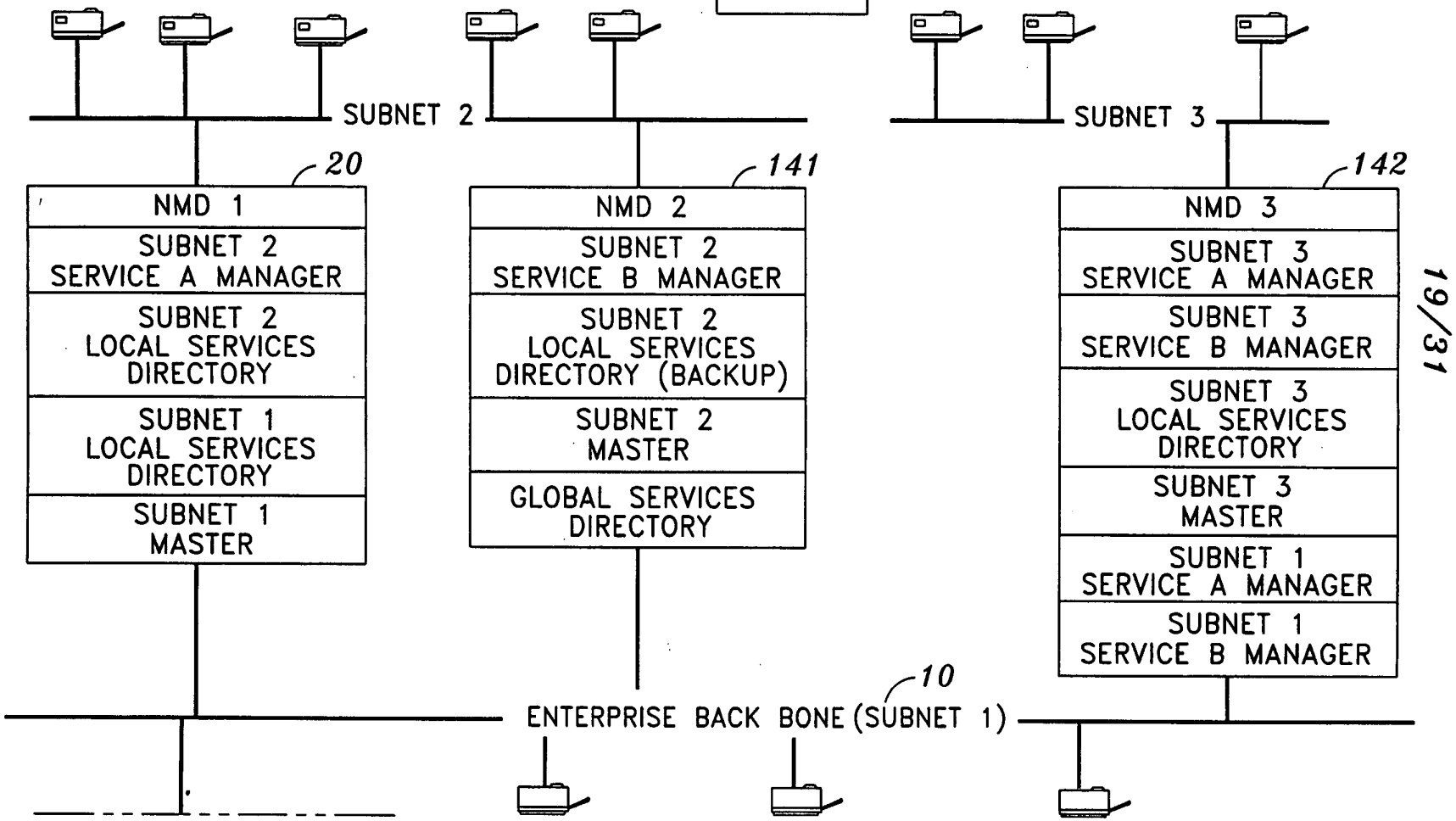


FIG. 16

FIG. 17

FIG. 17A



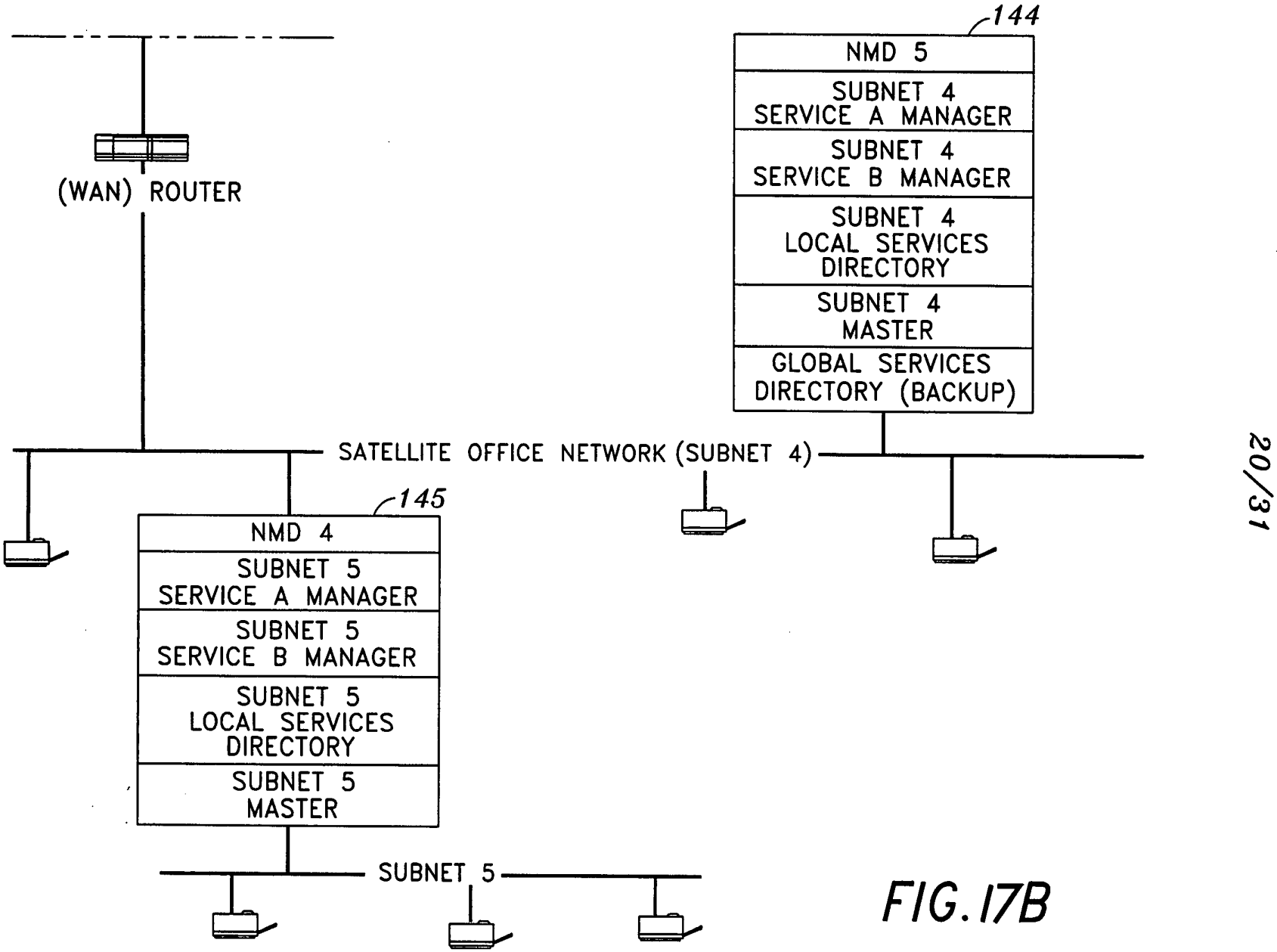

144
NMD 5
SUBNET 4
SERVICE A MANAGER
SUBNET 4
SERVICE B MANAGER
SUBNET 4
LOCAL SERVICES
DIRECTORY
SUBNET 4
MASTER
GLOBAL SERVICES
DIRECTORY (BACKUP)
(WAN) ROUTER
SATELLITE OFFICE NETWORK (SUBNET 4)
145
NMD 4
SUBNET 5
SERVICE A MANAGER
SUBNET 5
SERVICE B MANAGER
SUBNET 5
LOCAL SERVICES
DIRECTORY
SUBNET 5
MASTER
SUBNET 5

FIG. 17B

FIG. 18

FIG. 18A
FIG. 18B

FIG. 18A

	NMD 1	
SUBNET	COMPONENT	STATE
1	PRINTER QUEUE SERVICE	NOT RUNNING
1	DISCOVERY SERVICE	NOT RUNNING
1	LOCAL SERVICES DIRECTORY	RUNNING
1	MASTER	RUNNING
2	PRINTER QUEUE SERVICE	RUNNING
2	DISCOVERY SERVICE	NOT RUNNING
2	LOCAL SERVICES DIRECTORY	RUNNING
2	MASTER	NOT RUNNING
	GLOBAL SERVICES DIRECTORY	NOT RUNNING/BACKUP

20

	NMD 2	
SUBNET	COMPONENT	STATE
1	PRINTER QUEUE SERVICE	NOT RUNNING
1	DISCOVERY SERVICE	NOT RUNNING
1	LOCAL SERVICES DIRECTORY	NOT RUNNING/BACKUP
1	MASTER	NOT RUNNING
2	PRINTER QUEUE SERVICE	NOT RUNNING
2	DISCOVERY SERVICE	RUNNING
2	LOCAL SERVICES DIRECTORY	BACKUP
2	MASTER	RUNNING
	GLOBAL SERVICES DIRECTORY	RUNNING

141

FIG. 18B

NMD 3		
SUBNET	COMPONENT	STATE
1	PRINTER QUEUE SERVICE	RUNNING
1	DISCOVERY SERVICE	RUNNING
1	LOCAL SERVICES DIRECTORY	NOT RUNNING/BACKUP
1	MASTER	NOT RUNNING
3	PRINTER QUEUE SERVICE	RUNNING
3	DISCOVERY SERVICE	RUNNING
3	LOCAL SERVICES DIRECTORY	RUNNING
3	MASTER	RUNNING
	GLOBAL SERVICES DIRECTORY	NOT RUNNING/BACKUP

142

NMD 4		
SUBNET	COMPONENT	STATE
4	PRINTER QUEUE SERVICE	RUNNING
4	DISCOVERY SERVICE	RUNNING
4	LOCAL SERVICES DIRECTORY	RUNNING
4	MASTER	RUNNING
	GLOBAL SERVICES DIRECTORY	BACKUP

145

NMD 5		
SUBNET	COMPONENT	STATE
4	PRINTER QUEUE SERVICE	NOT RUNNING
4	DISCOVERY SERVICE	NOT RUNNING
4	LOCAL SERVICES DIRECTORY	NOT RUNNING/BACKUP
4	MASTER	NOT RUNNING
5	PRINTER QUEUE SERVICE	RUNNING
5	DISCOVERY SERVICE	RUNNING
5	LOCAL SERVICES DIRECTORY	RUNNING
5	MASTER	RUNNING
	GLOBAL SERVICES DIRECTORY	NOT RUNNING/BACKUP

144

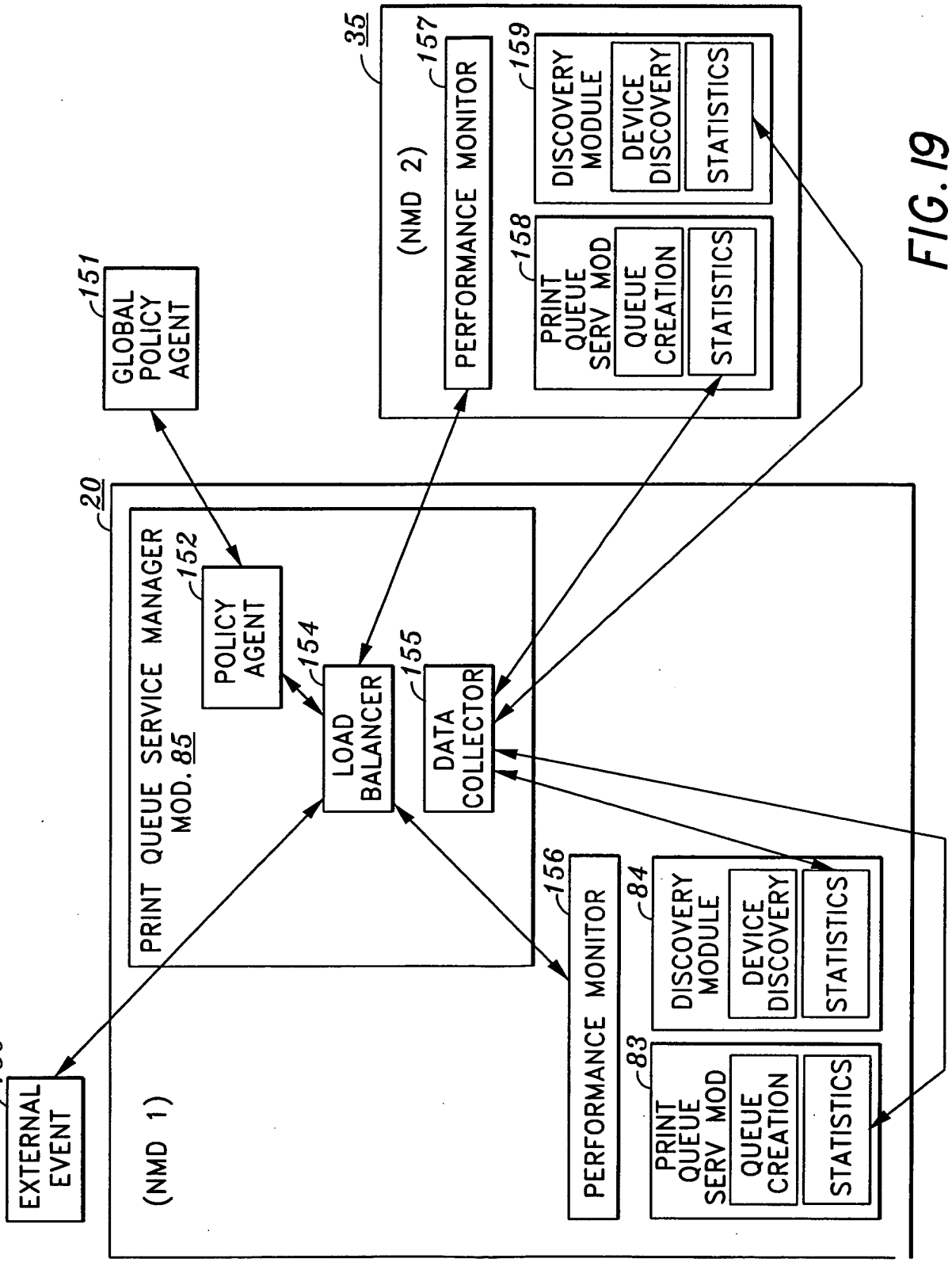

150
EXTERNAL EVENT
(NMD 1)
20
PRINT QUEUE SERVICE MANAGER MOD. 85
POLICY AGENT
152
LOAD BALANCER
154
DATA COLLECTOR
155
PERFORMANCE MONITOR
156
DISCOVERY MODULE
84
DEVICE DISCOVERY
STATISTICS
PRINT QUEUE SERV MOD
83
QUEUE CREATION
STATISTICS
GLOBAL POLICY AGENT
151
35
(NMD 2)
PERFORMANCE MONITOR
157
DISCOVERY MODULE
159
DEVICE DISCOVERY
STATISTICS
PRINT QUEUE SERV MOD
158
QUEUE CREATION
STATISTICS

FIG. 19

FIG. 20A

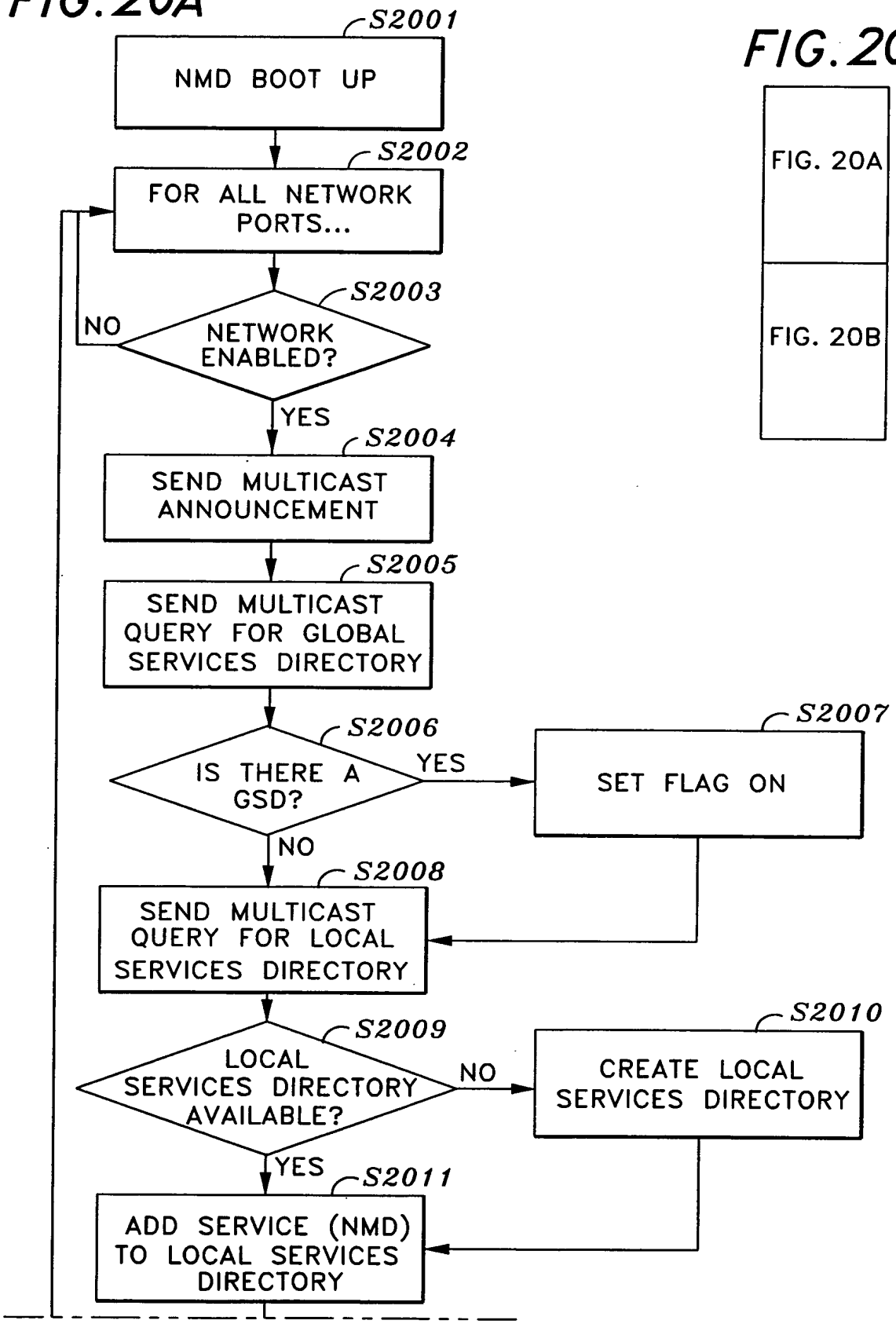


FIG. 20

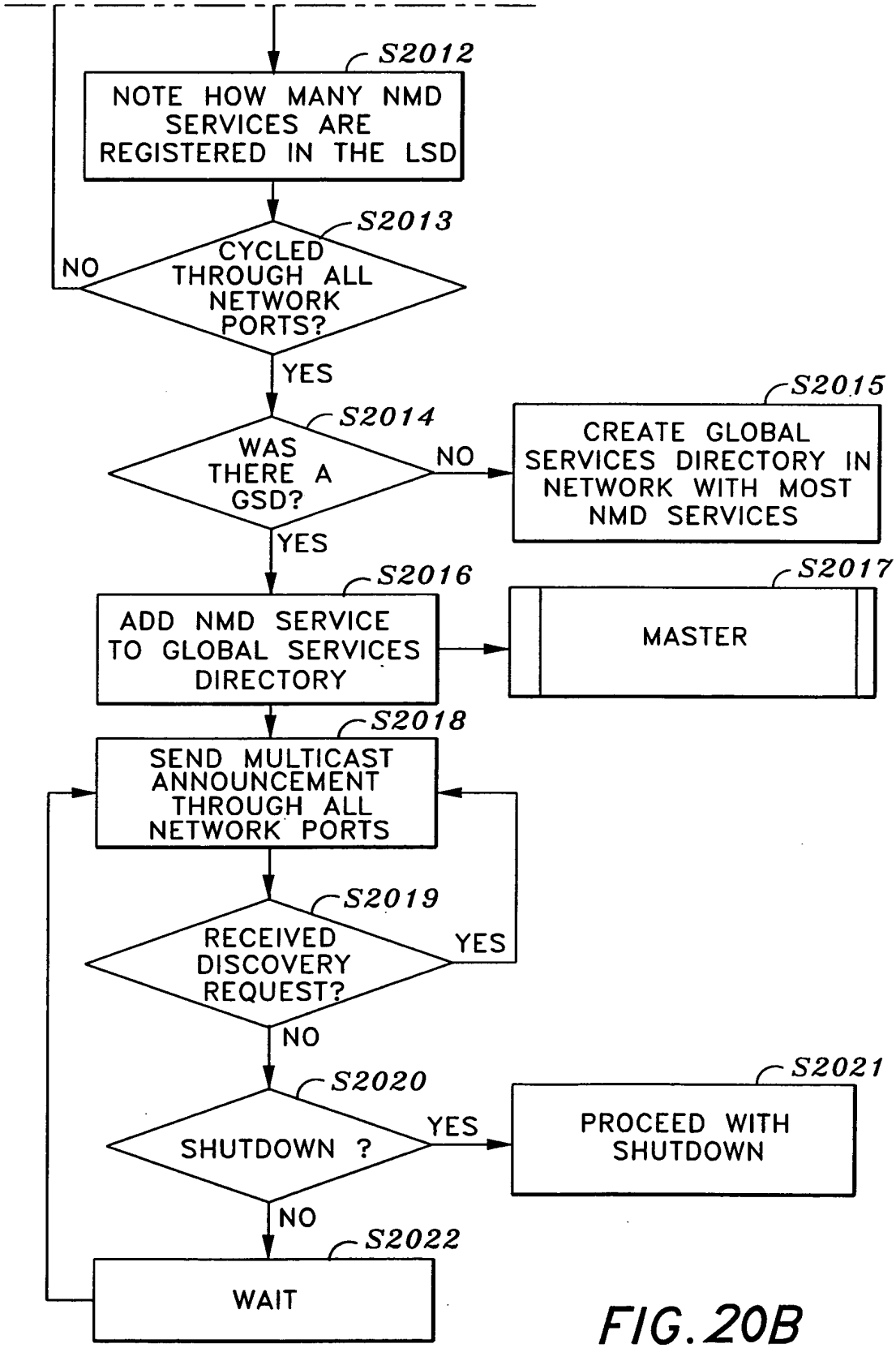

S2012
NOTE HOW MANY NMD SERVICES ARE REGISTERED IN THE LSD
S2013
CYCLED THROUGH ALL NETWORK PORTS?
NO
YES
S2014
WAS THERE A GSD?
NO
S2015
CREATE GLOBAL SERVICES DIRECTORY IN NETWORK WITH MOST NMD SERVICES
YES
S2016
ADD NMD SERVICE TO GLOBAL SERVICES DIRECTORY
S2017
MASTER
S2018
SEND MULTICAST ANNOUNCEMENT THROUGH ALL NETWORK PORTS
S2019
RECEIVED DISCOVERY REQUEST?
YES
NO
S2020
SHUTDOWN ?
YES
S2021
PROCEED WITH SHUTDOWN
NO
S2022
WAIT

FIG. 20B

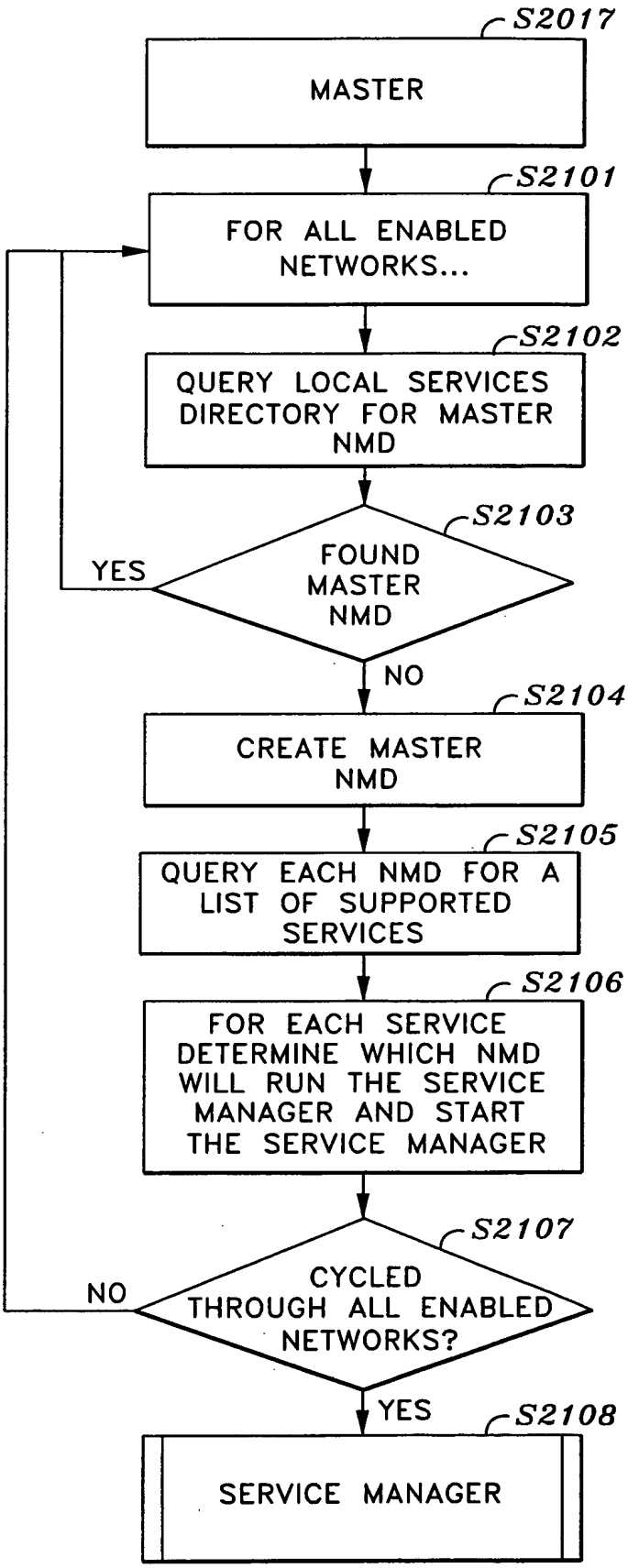

S2017
MASTER
S2101
FOR ALL ENABLED NETWORKS...
S2102
QUERY LOCAL SERVICES DIRECTORY FOR MASTER NMD
S2103
FOUND MASTER NMD
YES
NO
S2104
CREATE MASTER NMD
S2105
QUERY EACH NMD FOR A LIST OF SUPPORTED SERVICES
S2106
FOR EACH SERVICE DETERMINE WHICH NMD WILL RUN THE SERVICE MANAGER AND START THE SERVICE MANAGER
S2107
CYCLED THROUGH ALL ENABLED NETWORKS?
NO
YES
S2108
SERVICE MANAGER

FIG. 21

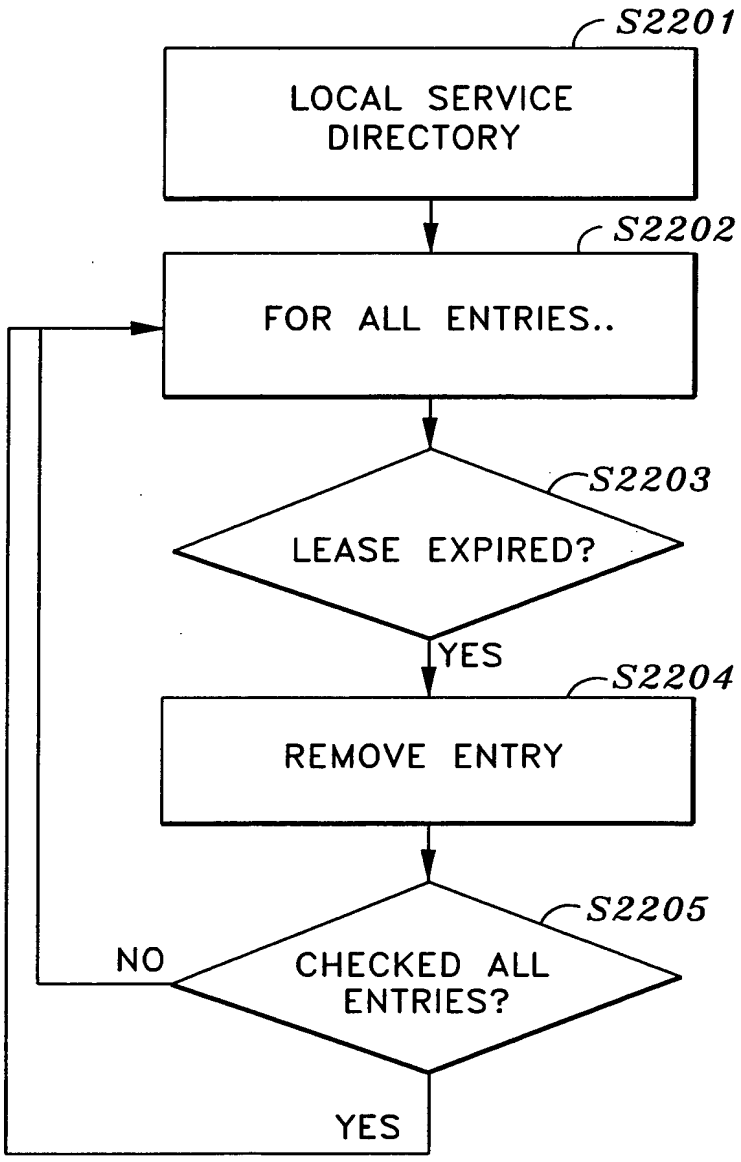

S2201
LOCAL SERVICE DIRECTORY
S2202
FOR ALL ENTRIES..
S2203
LEASE EXPIRED?
YES
S2204
REMOVE ENTRY
S2205
CHECKED ALL ENTRIES?
NO
YES

FIG. 22

FIG. 23

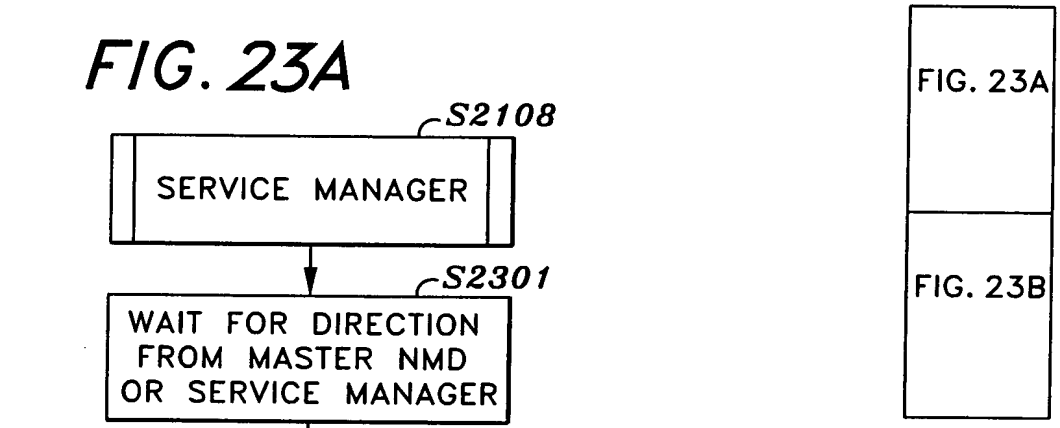
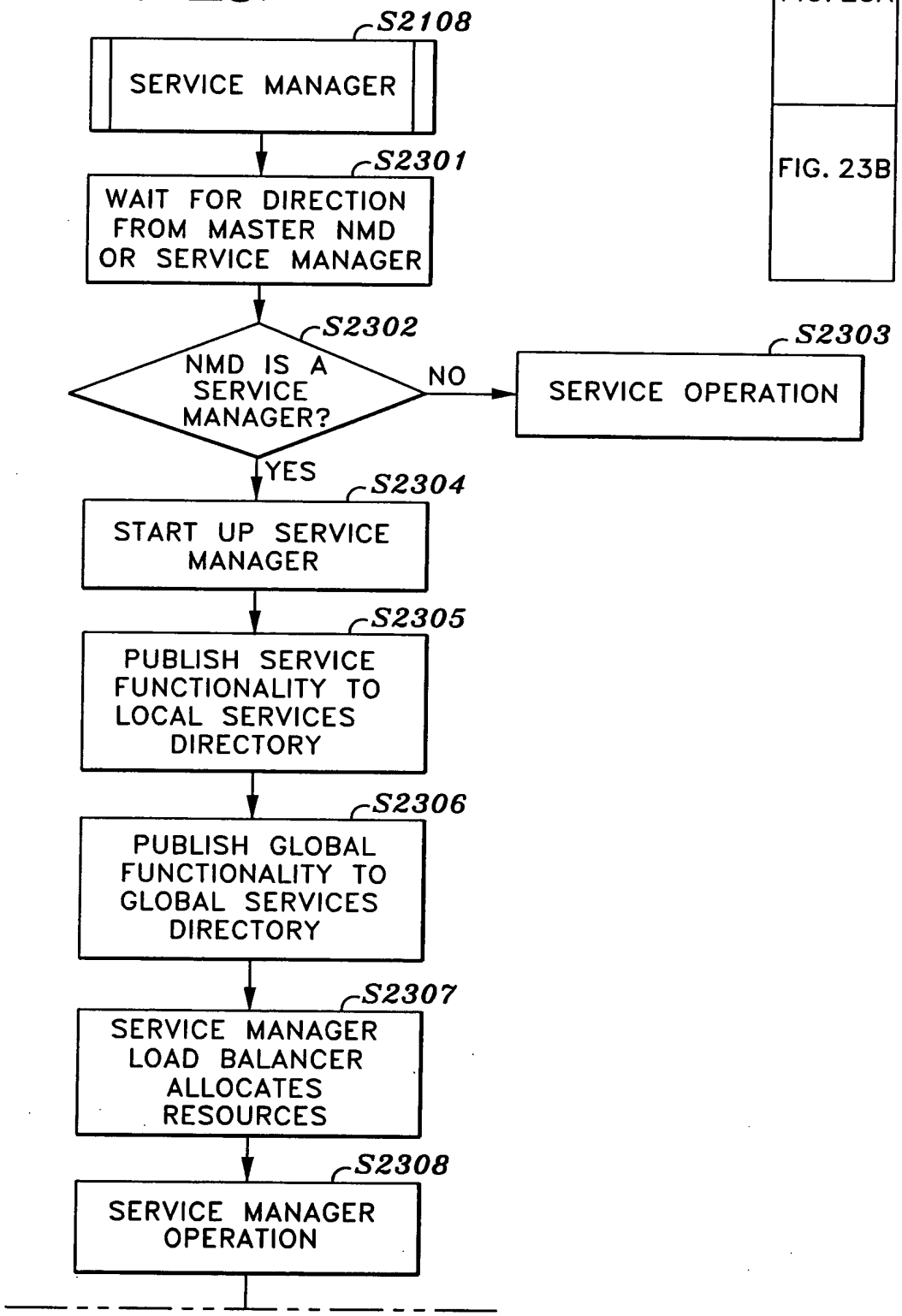


FIG. 23A



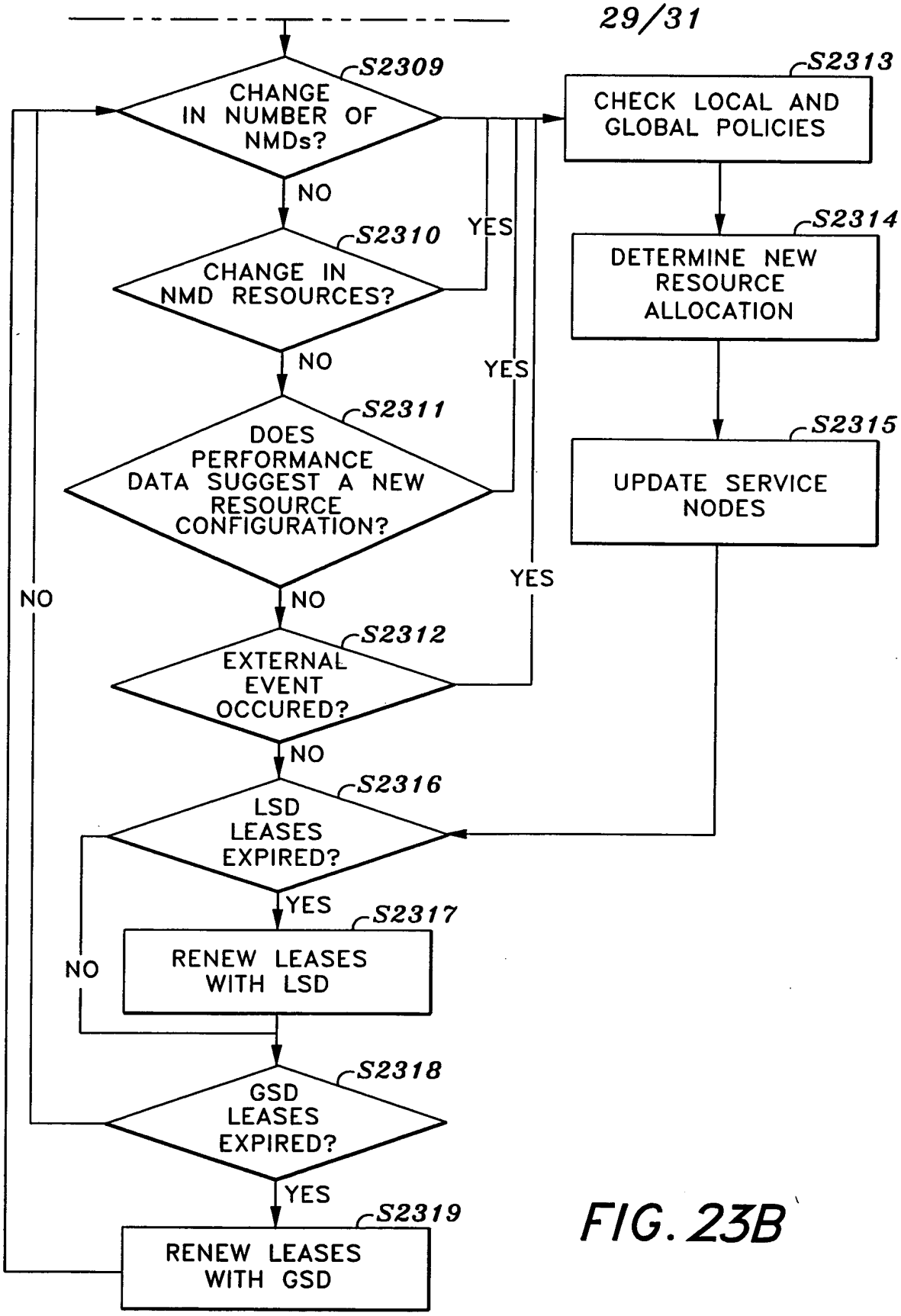

S2309
CHANGE IN NUMBER OF NMDs?
NO
YES
S2310
CHANGE IN NMD RESOURCES?
NO
YES
S2311
DOES PERFORMANCE DATA SUGGEST A NEW RESOURCE CONFIGURATION?
NO
YES
S2312
EXTERNAL EVENT OCCURED?
NO
YES
S2316
LSD LEASES EXPIRED?
YES
NO
S2317
RENEW LEASES WITH LSD
S2318
GSD LEASES EXPIRED?
YES
NO
S2319
RENEW LEASES WITH GSD
S2313
CHECK LOCAL AND GLOBAL POLICIES
S2314
DETERMINE NEW RESOURCE ALLOCATION
S2315
UPDATE SERVICE NODES

FIG. 23B

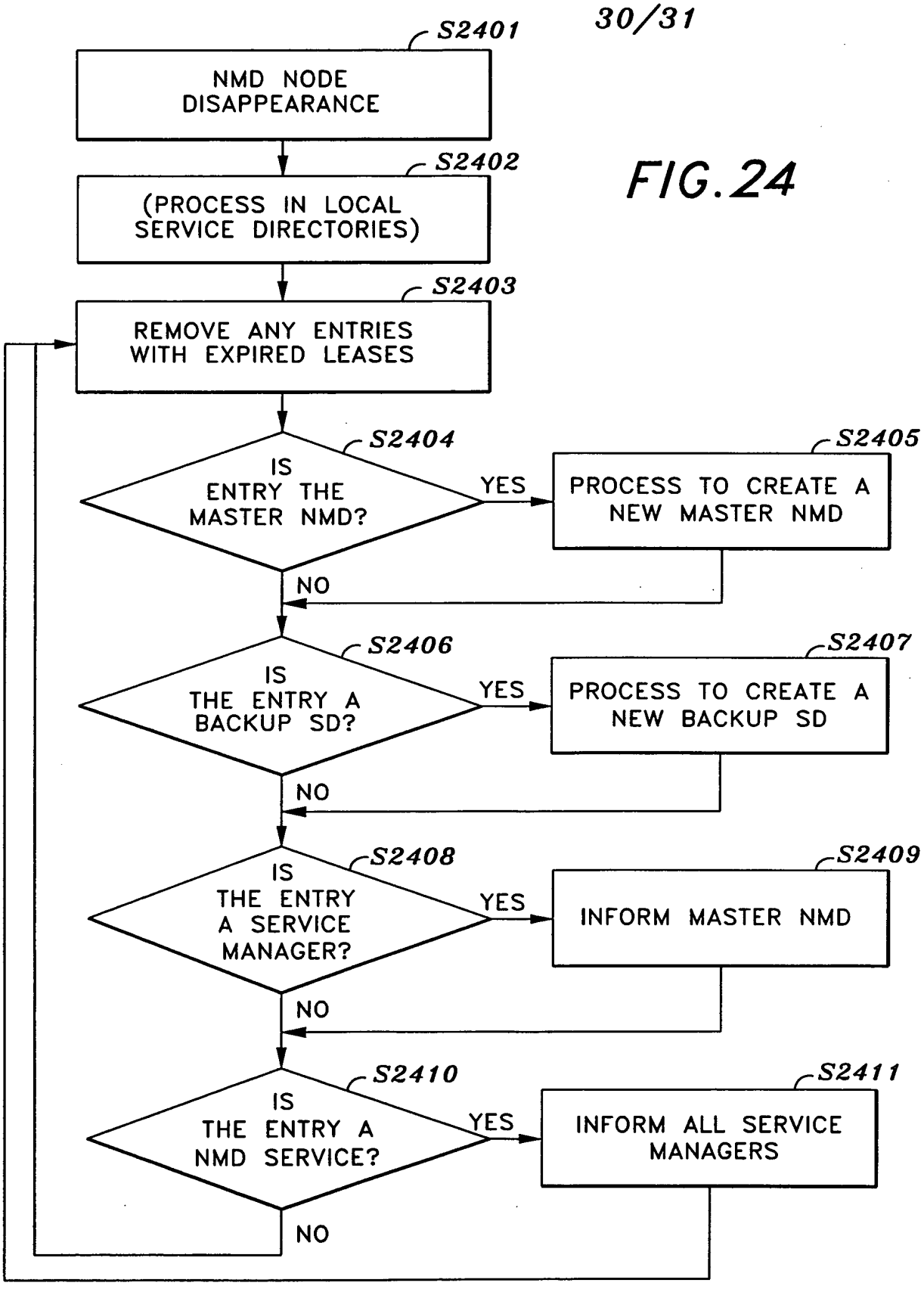

S2401
NMD NODE DISAPPEARANCE
S2402
(PROCESS IN LOCAL SERVICE DIRECTORIES)
S2403
REMOVE ANY ENTRIES WITH EXPIRED LEASES
S2404
IS ENTRY THE MASTER NMD?
YES
S2405
PROCESS TO CREATE A NEW MASTER NMD
NO
S2406
IS THE ENTRY A BACKUP SD?
YES
S2407
PROCESS TO CREATE A NEW BACKUP SD
NO
S2408
IS THE ENTRY A SERVICE MANAGER?
YES
S2409
INFORM MASTER NMD
NO
S2410
IS THE ENTRY A NMD SERVICE?
YES
S2411
INFORM ALL SERVICE MANAGERS
NO

FIG. 24

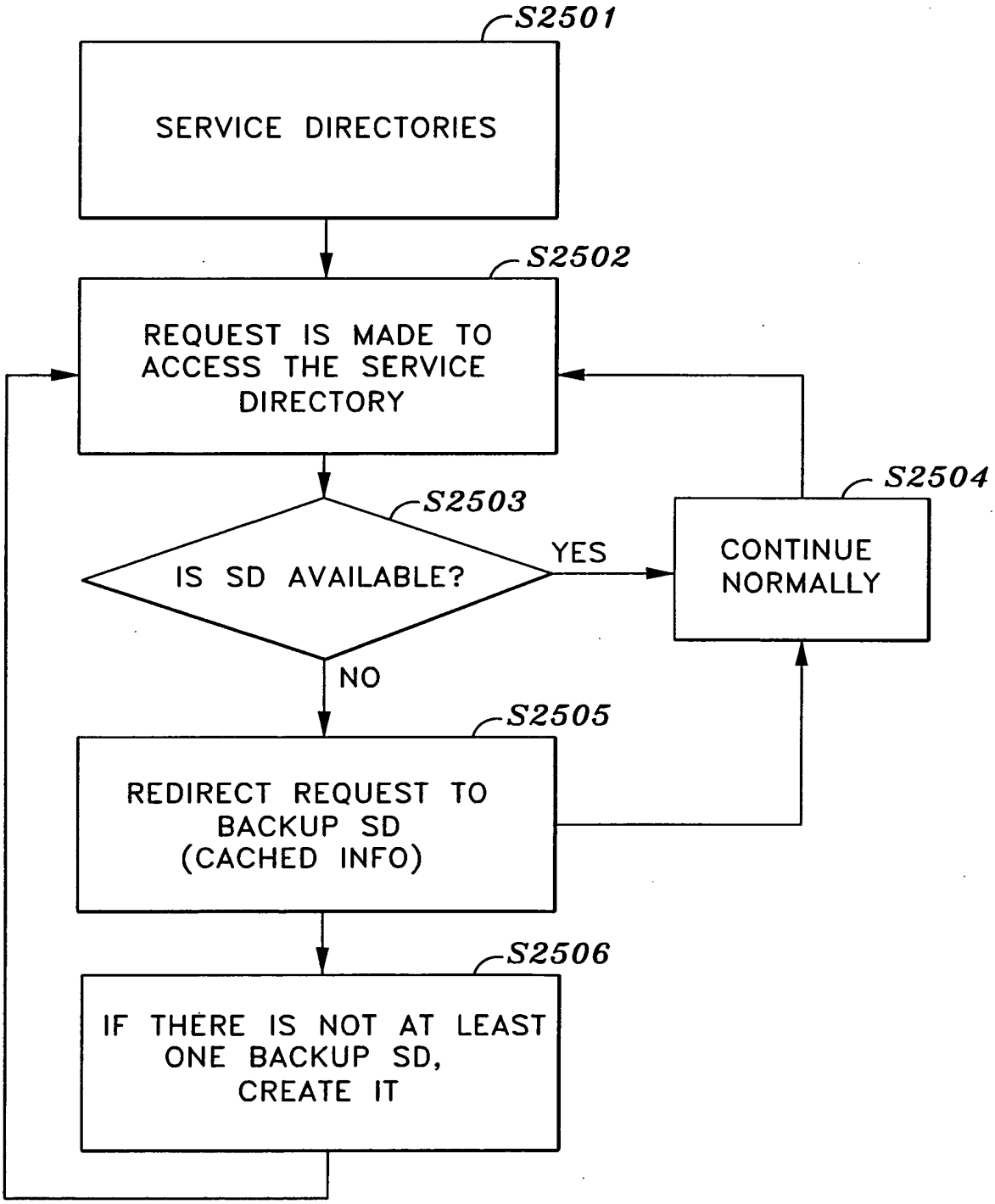

S2501
SERVICE DIRECTORIES
S2502
REQUEST IS MADE TO ACCESS THE SERVICE DIRECTORY
S2503
IS SD AVAILABLE?
YES
S2504
CONTINUE NORMALLY
NO
S2505
REDIRECT REQUEST TO BACKUP SD (CACHED INFO)
S2506
IF THERE IS NOT AT LEAST ONE BACKUP SD, CREATE IT

FIG. 25